DISLOCATION OF THE OUTER END OF THE CLAVICLE.

WITH REPORT OF FOUR CASES.

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Dislocations of the outer end of the clavicle may be divided into two classes: 1, Cases in which the coracoclavicular ligaments are completely torn; and, 2, cases in which a complete rupture of the coracoclavicular ligaments has not occurred.

By physical examination, we can distinguish these two classes clinically.

Dislocations of the outer end of the clavicle, without complete rupture of the coracoclavicular ligaments, can be treated successfully without operative intervention.

Dislocations of the outer end of the clavicle, with complete rupture of the coracoclavicular ligaments, require operative procedures to secure satisfactory results.

I.

Six out of forty-four original articles on dislocations of the outer end of the clavicle mention the pathology of the condition. Robert T. Morris[1] and James E. Moore[2] each report one case in which complete rupture of the coracoclavicular and acromioclavicular ligaments was observed at operation. T. H. Manley[3] states that in all cases of dislocations of the outer end of the clavicle the capsule of the joint is completely torn and the coracoclavicular ligaments probably ruptured. He reports four cases, but makes no mention of actual experiments or observations concerning the nature or extent of the injury. Dr. Kreeke[4] reports two cases in which he determined at operation that a complete rupture of the coracoclavicular ligaments existed. He states that a complete dislocation of the outer end of the clavicle can occur without complete rupture of the coracoclavicular ligaments, but gives no proof in support of the statement. He states, also, that in all "severe" cases the coracoclavicular ligaments are completely torn. Paul Poirier and Henri Rieffel[5] record observations on two cases treated by operation. From these cases, and from experiments on cadavers, they believe (1) that the acromioclavicular ligaments are torn in all cases; (2) that the conoid ligament is sometimes torn in incomplete dislocations; (3) that the conoid ligament is always torn in complete cases; (4) that both conoid and trapezoid ligaments are frequently completely torn in complete cases. They admit, however, that the trapezoid ligament may not be completely torn in cases of complete dislocation. N. D. Edwards[6] reports a case of dislocation of the clavicle under the acromion process. He states that the coracoclavicular ligaments are torn in this variety of dislocation, but records no observations or experiments to support the statement.

My experience corresponds closely with that of Poirier and Rieffel. I have operated on two complete cases, and observed complete rupture of the coracoclavicular ligaments in each. I have produced dislocations of the outer end of the clavicle eight times by experiments on cadavers. In three experiments the deformity was characteristic, but the outer end of the clavicle was not freely movable. In these cases the coracoclavicular ligaments were only partially torn. In three shoulders, in which more injury was done, the clavicle was freely movable, and on examination the coracoclavicular ligaments were completely ruptured. In two cases I was unable to produce the dislocation without first severing the acromioclavicular ligaments. I then produced the dislocations and found the coracoclavicular ligaments completely torn. In attempting to produce the desired dislocation in two cases, I fractured the clavicle, rendering the subjects unfit for further experimentation. In all cases the acromioclavicular ligaments were completely torn, but the tearing was irregular. I did not succeed in detaching the superior acromioclavicular ligament from the clavicle, as was observed to have been the case in the patient reported by Moore.[2]

II.

The reports of the cases of dislocations of the clavicle are of little value in aiding us to determine the extent of the injury from the symptoms present. The reports by Tracy,[7] Krecke,[4] Budinger,[8] and Albers [9] are the only ones that discuss the deformity with any degree of definiteness. On account of these brief reports, I believe it to be impossible to draw definite conclusions. However, I think that certain important signs will enable the surgeon to determine positively if a complete rupture of the coracoclavicular ligaments exists. I shall discuss these signs separately.

(*a*) Inability to reduce the dislocation. There are three cases of this character recorded. Moore [2] examined his case at operation, and noted that the coracoclavicular ligaments were completely torn. The two other cases were reported by Nicaise [10] and Reynier.[11] These cases were not exposed by incision. Moore obtained a good result in his case. The results in the other cases were very unsatisfactory.

Reynier claims to be the first to observe a case of dislocation of the outer end of the clavicle that could not be reduced. He reported his case in 1877, and therewith mentions a case observed by M. Nicaise. Nicaise reported his case in the *Lancet* in 1876. Reynier's observation may have been made first, but Nicaise's report was first put into print.

(*b*) Extent of the deformity. Only four authors write definitely on this subject. In Albers's case the outer extremity of the clavicle could be separated six centimetres from the articular surface of the acromion. He operated and obtained a good result. He does not mention the coracoclavicular ligaments; but it is reasonable to suppose that they were completely torn. Budinger [8] reports a case in which the displacement was four centimetres. He operated, but, like Albers, does not mention the coracoclavicular ligaments. Krecke [4] reports two cases in which the displacement was three centimetres.

From observations on cadavers, and from examining two cases herewith reported (*vide infra*), I believe that in all cases where the articular surfaces of the clavicle and acromion can be separated one inch, the coracoclavicular ligaments are completely ruptured.

(*c*) Recurrence of the deformity (mentioned by Albers,[9] Hofmann,[12] and Kreeke[4]) is a symptom which indicates serious injury to the soft parts, and, I am inclined to believe, does not occur unless the coracoclavicular ligaments are destroyed.

(*d*) Longitudinal separation of the acromion from the clavicle. In one case (*vide infra*) I was able to separate the acromion from the articular surface of the clavicle one-third of an inch. Operation revealed a complete rupture of the coracoclavicular ligaments. The test was applied as follows: I stood on the injured side of the patient, facing the shoulder. I then placed one hand in the patient's axilla and drew the humerus towards me, resting his elbow against my abdomen. By using slow and steady traction, I was able to separate the articular surfaces of the clavicle and acromion about one-third of an inch. In the same case I could grasp the outer end of the clavicle and easily elevate it above the acromion.

I should diagnose probable complete rupture of the coracoclavicular ligaments in all cases of dislocation of the outer end of the clavicle presenting any of the following conditions: (1) Inability to reduce the dislocation. (2) Separation of the articular surfaces more than one inch. (3) Ability to produce a longitudinal separation of the articular surfaces one-third of an inch, or to easily elevate the outer end of the clavicle. (4) Marked tendency to recurrence of the dislocation.

III.

There are many examples of dislocations of the outer end of the clavicle treated successfully without operation. From the symptom of such cases, it is probable that the coracoclavicular ligaments remained intact. I can find no report of a case presenting symptoms of dislocation of the outer end of the clavicle without complete rupture of the coracoclavicular ligaments that was not treated successfully without operative interference. Thirty-six such cases have been recorded.

The second part of proposition III, namely, that dislocations of the outer end of the clavicle, with complete rupture of the coracoclavicular ligaments, require operative procedures to secure satisfactory results, is not easily proven. I can find reports of eight cases, with doubtless complete rupture of the coracoclavicular ligaments, treated without operation, in which the results were either complete failures or were unsatisfactory.

Nicaise[10] and Reynier[11] report a case in which the deformity could not be reduced. Of course, the results were unsatisfactory. Newman[13] reports a similar case. The results were not given, as the patient went to "a bone-setter" for further treatment. This suggests that the result was not perfect. Mr. Hulke[14] treated a case of complete dislocation of the outer end of the clavicle, and states that four weeks after the injury the patient had fair use of the arm. Dr. Albers[15] treated a case of complete dislocation without operation, and states that after several weeks' treatment there was deformity and considerable loss of function. T. H. Manley[3] reports two cases (I and III) with poor results. These cases were neglected, and do not give a fair test of the non-operative treatment. W. F. Gibb[16] reports a complete case treated without operation. The result gives us no information, the patient died eight days after being injured.

I can find the report of one case (Davis[17]) of dislocation of the outer end of the clavicle, with symptoms pointing to complete rupture of the coracoclavicular ligaments, that was treated without operation and a satisfactory result obtained.

From the foregoing reports (a good result in one out of nine cases), it is evident that in cases of dislocation of the outer end of the clavicle, with symptoms pointing to complete rupture of the coracoclavicular ligaments, non-operative treatment will rarely give satisfactory results. On the other hand, operation in these cases has been successful without exception. Fifteen cases operated and no failures.

I shall describe briefly the operated cases.

CASES I and II (Paul Poirier and Henri Rieffel)[5] were complete dislocations of the outer ends of the left clavicles. The bones were drilled and silver wire used to approximate. On the twenty-second day in one case, and the twenty-third in the other, the results were perfect.

CASES III and IV (Dr. Albers)[9].—The patient was twenty-eight years old, and received the dislocation by falling. The clavicle and acromion were separated six centimetres. Non-operative treatment was tried six days, but was unsatisfactory. The operation consisted of incision, drilling bones, wiring with heavy silver wire, and approximation of soft structures with catgut. The result was perfect in four weeks. Albers's second case corresponds to the one given.

CASES V and VI.—Morris[13] reports two cases treated by drilling into the acromion and end of the clavicle, and retaining the bones in position by inserting a silver dowel-pin, one inch long, into the drilled holes. The joints were ankylosed, but the results were perfect.

CASE VII.—J. O'Connor[10] operated a case as follows: Curved incision, holes drilled, and two wires passed (does not mention kind of wire used); wound drained with iodoform gauze. There was no infection. The patient was discharged on the thirty-first day with a perfect result.

CASE VIII (Reynier)[11].—Two months after the injury occurred, Reynier exposed the dislocation; severed a portion of the trapezius to complete reduction, and wired the bones in position with silver wire. The result was perfect. Reynier claims to be the first to wire a dislocated clavicle; also states that he has wired two other cases, but does not report them in detail.

CASES IX and X (Dr. Kreeke)[4].—Kreeke treated two cases by exposing the bones and wiring them in position with two silver wires. Good results were obtained in each case.

CASE XI.—Budinger[8] reports a case treated as follows. Exposure of joint; drilling and passing silk sutures. He could not retain the fragments satisfactorily with this method, so drove a drill-point horizontally through the acromion into the clavicle five centimetres. This retained the bones in perfect position. The wound remained clean. On the eighteenth day the drill-point was removed, and seven days later the patient was discharged cured.

CASE XII (Moore)[7].—On the third day, Moore exposed the joint by incision; reduced the dislocation, and retained the bones in position with silver-wire sutures. Five weeks later the wires were removed. The result was satisfactory.

These reports demonstrate the advisability of operation in all cases in which we might expect doubtful results by non-operative treatment; and the results may be termed doubtful when a complete rupture of the coracoclavicular ligaments can be diagnosed. There is only one case[17] reported, with symptoms pointing to complete rupture of the coracoclavicular ligaments, that terminated favorably without operation. G. Lafon[20] recognized that the non-operative treatment was often inefficient. He states that the ordinary bandages and apparatus often fail to give good retention of the parts. Then suturing seems advisable. Dr. Albers[9] had some unsatisfactory results in treating dislocations of the outer end of the clavicle with non-operative methods. In a paper published in 1894 he advised operation in all complete cases. T. H. Manley[3] states that the treatment of this condition is very unsatisfactory. He reports four cases, but has had no experience with the operative treatment. Carl Scholz[21] speaks of the difficulties met with in handling some cases. He says that most surgeons pass rapidly over the subject of these dislocations, giving one the impression that they have not much faith in their own methods. He favors operative treatment. Budinger[8] says that the results in these cases are in many instances bad. He favors operative treatment, and is of the opinion that, even if a dressing or apparatus can be found that will hold the parts in position, there is always the danger of gangrene or decubitus ensuing.

Although most writers who have studied the subject favor operation, many cases are reported with good results obtained by non-operative treatment. However, most of these reports are of single cases; in only one have we reason to believe that the coracoclavicular ligaments were completely ruptured; and many times the cases were reported to demonstrate a dressing or apparatus supposed to be especially effective in treating this form of dislocation. With regard to the more severe cases, there are a few statements, which I find quoted without references, that are of more or less interest. Hoffa says that most complete cases recover without marked disturbance of function, although with more or less deformity. Discher, König, and Tillmanns state that, even when marked displacement results, function may be perfect. Von Bergman and von Volkman say that they have never observed any disturbance except deformity to follow this dislocation. Defranceschi saw in three cases complete restoration of function despite the deformity. Bardenheuer, on the other hand, has seen marked disturbance of function in a case treated with care and thoroughness; and Hamilton saw two cases in which the disturbance of function was so marked that the patients could not raise their arms from their sides. I believe that the diversity of opinion that has existed in regard to treatment strengthens the arguments that I have been supporting. If the indication for operative treatment depends on the extent of the injury, a pathologic diagnosis must be made before the proper treatment can be advised. If a pathologic diagnosis is ignored, or cannot be made, the opinion of the surgeon, regarding treatment, will depend entirely on the type of cases he has treated. For this reason, radical statements concerning treatment should have their sources investigated before being accepted. The advice of Dr. Kreeke on this subject appeals to me as being reliable and practical. He advises operation in complete cases in which the deformity is marked. He is of the opinion that in most of these cases the non-operative treatment is unsatisfactory, and states that operation is without danger, is easy to perform, and gives good results.

METHODS OF OPERATING.

Cooper was the first to do the open operation. In 1861, he exposed a dislocation, resected the ends of the bones, and retained them in position by drilling and uniting them with a suture. Although he obtained a good result, the operation did not come much into use till 1889, when Paci employed it. In the same year (1889) J. Wolff sutured a case with silver wire. The result was good, but, as a fistula remained, the wires were later removed. Following these cases, Poirier, Rieffel, and Le Bec report similar ones. In 1894 Albers reported a case wired successfully; and Kreeke recorded a similar one in 1897. Although incision, drilling, and wiring have been generally used in treating these cases, other methods have been resorted to. In 1885 Baum passed carbolized silk, subcutaneously, through the end of the ligamentum acromioclaviculare and coracoclaviculare, replaced the dislocation, and tied the ends over a roll of adhesive plaster on the skin. Bardenheuer recommended the Malgaigne clamp, but reports no cases in which it was used. Morris, in 1895, treated two cases by incision, drilling the articular surfaces of the acromion and apposed end of the clavicle, and inserting a stiff silver dowel-pin, one inch in length, into the drilled holes. The two articular surfaces were then pushed together and remained easily in the normal position, held by the dowel-pin. Budinger treated a case by driving a long drill-point through the acromion into the outer end of the clavicle. This held the bones in position, and a good result was obtained. The drill was removed on the fourteenth day.

The most approved method is exposure of the joint by incision; drilling the clavicle and acromion; passing and tieing two absorbable sutures; approximating ligaments and fascia with fine catgut; suturing the skin wound with silkworm gut. Drainage is not necessary. In operating old cases, it may be necessary to free the clavicle from cicatricial tissue before complete reduction of the dislocation can be accomplished.

There is some diversity of opinion with regard to the material to be used in suturing the bones in position. Silver wire has generally been selected. I believe that absorbable material will be more satisfactory; Moore is of the same opinion. The wire sometimes becomes a source of irritation, and its removal may become necessary. Wolff and Moore report such cases.

Case I.—A male, twenty-nine years old, was thrown from an express wagon, striking on his left shoulder. Examination showed an upward dislocation of the outer end of the clavicle which slightly overlapped the acromion. The displacement was not marked and the clavicle was not easily movable. Reduction was easily accomplished by making traction on the arm. The dislocation did not recur. A strip of adhesive plaster was placed over the outer end of the clavicle and under the elbow. This held the bones in position. On the twenty-second day the plaster was removed, and on the thirtieth day the patient resumed work. There was very little deformity and no impairment of function.

CASE II.—Herman J., a miner, thirty years of age, was thrown from a rapidly moving car. Examination showed a dislocation of the outer end of the right clavicle. The clavicle overlapped the acromion one inch, and was easily movable. It was also possible to elevate the clavicle from the acromion. The dislocation was easily reduced, but recurred promptly on releasing the parts. Various dressings were tried for four weeks; still, the clavicle was movable and the dislocation recurred. Operation was then performed: Incision; freshening articular surfaces with a curette; drilling; passing two No. 3 chromicized catgut sutures through the drilled holes; tieing the bones in position; suturing the superior acromioclavicular ligament with No. 1 plain catgut; closure of the wound, without drainage, with silkworm-gut sutures. The wound healed by primary intention. Six weeks after the operation was performed the patient resumed work. The deformity was slight. Function seemed perfect.

CASE III.—Harry Y., a conductor, thirty-four years old, came to me with the following history: Eighteen months previously he received an injury to his shoulder by being thrown from a caboose. His treatment consisted of local applications and carrying the arm in a sling. He had considerable motion in the forearm and some in the arm, but the entire extremity was very weak. Voluntary movement of the arm was painful. Examination showed a drooping of the affected shoulder, with separation of the articular surfaces of the clavicle and acromion one-half an inch. The outer end of the clavicle was moved with difficulty.

Operation.—The joint was exposed and the articular surfaces freshened with a curette. The dislocation could not be reduced on account of the clavicle having grown to the coracoid process. The clavicle was then freed by passing a chisel along the under surface of the bone. The dislocation was then reduced, the bones drilled and wired with two silver wires, and the soft parts closed without drainage. The wound healed by primary intention. Very little deformity remained, but function returned slowly. Seven months after the operation was done the arm was strong enough to be used for ordinary work. Motion was not limited or painful at this time.

CASE IV.—I am indebted to Dr. R. Sonnenschein for the report of this case.

A man, thirty-five years old, was injured by a heavy box falling against the posterior aspect of his shoulder. Examination showed the outer end of the left clavicle to be displaced one inch above the acromion. An X-ray examination verified the diagnosis. The dislocation could be reduced easily, but recurred as soon as the parts were released. Operation was done as follows: Exposure of joint; drilling of clavicle and acromion; insertion of two heavy silver wires; closure of soft parts with catgut and silkworm gut. The patient progressed favorably, but there was a slight superficial infection. Six weeks later the extremity was still weak, but was improving. Motion was somewhat limited when the arm was elevated beyond the horizontal position.

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